PATENT ABSTRACTS OF JAPAN

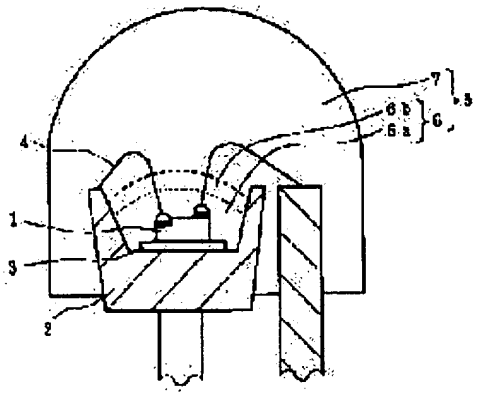
(11)Publication number : 2000-183408
(43)Date of publication of application : 30.06.2000

(51)Int.Cl. H01L 33/00
C01B 25/45
C09K 11/64
C09K 11/73
// C01F 17/00

(21)Application number : 10-357643
(22)Date of filing : 16.12.1998

(71)Applicant : TOSHIBA ELECTRONIC ENGINEERING CORP
TOSHIBA CORP
(72)Inventor : SUDO NOBUYUKI
TERAJIMA KENJI
FURUKAWA CHISATO

(54) SEMICONDUCTOR LIGHT-EMITTING DEVICE



(57)Abstract:
PROBLEM TO BE SOLVED: To obtain white light for stabilizing chromaticity with simple constitution in a semiconductor light-emitting device, such as an LED lamp.
SOLUTION: An LED chip 1 capable of emitting ultraviolet light is used. The chip 1 is fixed on a lead frame 2 and connected to the frame 2 by a bonding wire 4. A 1st phosphor layer 6a, containing a blue light-emitting phosphor for absorbing ultraviolet light and emitting blue light, is formed on the light emitting surface of the chip 1 and a 2nd phosphor layer 6b containing a yellow-orange light-emitting phosphor for absorbing blue light and emitting yellow-orange light is formed on the surface of the layer 6a.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of

rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

[Claim(s)]

[Claim 1] The semi-conductor luminescence equipment characterized by to provide the 2nd fluorescent substance layer containing the yellow orange luminescence fluorescent substance which is formed on the luminescence side of the luminescence chip which emits light in ultraviolet radiation, and said luminescence chip, is formed on the 1st fluorescent substance layer containing the blue luminescence fluorescent substance which absorbs said ultraviolet radiation and emits light in blue glow, and said 1st fluorescent substance layer, absorbs said blue glow, and emits light in yellow orange light.

[Claim 2] In semi-conductor luminescence equipment according to claim 1 said blue luminescence fluorescent substance general formula: (M1, Eu) -- 10(PO4) 6 and Cl2 (the inside of a formula, and M1 -- Mg --) it is chosen out of calcium, Sr, and Ba -- at least -- one sort of elements -- being shown -- it is expressed substantially a divalent europium activation halo phosphate fluorescent substance -- general formula: -- a(M2, Eu) O-bAl 2O3 (the inside of a formula, and M2 -- Mg --) It is as being chosen out of calcium, Sr, Ba, Zn, Li, Rb, and Cs that it is few. One sort of elements are shown. a and b -- a> 0, b> 0, and 0.2 <=a/b<=1.5 the number to satisfy -- it is -- it is expressed substantially a divalent europium activation aluminate fluorescent substance -- And a general formula: a(M2, Euv, and Mnw) O-bAl 2O3 (among a formula) M2 It is as being chosen out of Mg, calcium, Sr, Ba, Zn, Li, Rb, and Cs that it is few. One sort of elements are shown. a, b, v, and w a> 0, b> 0, and 0.2 <=a/b<=1.5, 0.001 <=w/v<=0.6 the number to satisfy -- it is -- it is expressed substantially it is chosen out of divalent europium and a manganese activation aluminate fluorescent substance -- at least -- Semi-conductor luminescence equipment characterized by consisting of one sort.

[Claim 3] In semi-conductor luminescence equipment according to claim 1, said yellow orange luminescence fluorescent substance is expressed with general formula:(Y1-x-y Gdx Cey)3 aluminum 5O12 (y is the inside of a formula, x and 0.1<=x<=0.55, and a number with which are satisfied of 0.01<=y<=0.4).

Semi-conductor luminescence equipment characterized by consisting of a trivalent cerium activation aluminate fluorescent substance.

[Claim 4] It sets to the semi-conductor luminescence equipment of claim 1 thru/or claim 3 given in any 1 term, and is said luminescence chip. It is semi-conductor luminescence equipment characterized by being covered with the resin layer which has a laminated structure more than two-layer, and containing said blue luminescence fluorescent substance and the yellow orange luminescence fluorescent substance according to an individual in the resin layer which has said laminated structure.

[Claim 5] It is semi-conductor luminescence equipment characterized by forming said 1st and 2nd fluorescent substance layers in order as a spreading layer of a fluorescent substance on the luminescence side of said luminescence chip in the semi-conductor luminescence equipment of claim 1 thru/or claim 3 given in any 1 term.

[Claim 6] In the semi-conductor luminescence equipment of claim 1 thru/or claim 5 given in any 1 term said 1st and 2nd fluorescent substance layers Semi-conductor luminescence equipment characterized by being constituted by the blue glow to which said 1st fluorescent substance layer absorbs said ultraviolet radiation, and emits light, and the yellow orange light in which said 2nd fluorescent substance layer absorbs said blue glow, and emits light so that the light of a desired white system may be obtained.

[Claim 7] It is semi-conductor luminescence equipment which said luminescence chip is fixed on a leadframe in the semi-conductor luminescence equipment of claim 1 thru/or claim 6 given in any 1 term, and is characterized by said luminescence chip and leadframe being connected by the bonding wire.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the semi-conductor luminescence equipment which raised the stability of luminescence of a white system.

[0002]

[Description of the Prior Art] In semi-conductor luminescence equipments, such as an LED lamp using light emitting diode (Light Emitting Diode:LED), obtaining the luminescent color other than the luminescent color of LED chip original, for example, the white light, is put in practical use by applying a fluorescent substance to the front face of an LED chip, or making fluorescent substance powder contain in the resin which constitutes an LED lamp.

[0003] With the semi-conductor luminescence equipment which emits such the

white light, main wavelength is abbreviation. It is common to use the GaN system LED chip which emits light in the blue near 450nm. That is, it is yellow orange luminescence to the front face of the GaN system LED chip of blue luminescence. The layer containing a trivalent cerium activation ulmin acid yttrium (YAG) fluorescent substance is formed, and it is blue luminescence from an LED chip. He changes with a trivalent cerium activation ulmin acid yttrium (YAG) fluorescent substance, and is trying to acquire the white light.

[0004] The manufacture approach of this kind of semi-conductor luminescence equipment is explained briefly. First, after mounting the GaN system LED chip of blue luminescence on a leadframe, a leadframe and an LED chip are connected by the bonding wire. Next, it is yellow orange luminescence about the perimeter of an LED chip and a bonding wire. It covers and heat-treats by the pre DIP material which mixed the trivalent cerium activation ulmin acid yttrium (YAG) fluorescent substance, and pre DIP material is stiffened. This pre DIP material functions as a fluorescent substance layer of yellow orange luminescence. The outside of pre DIP material is covered by the casting material which served as the lens. Each of pre DIP material and casting material consists of thermosetting resin.

[0005]

[Problem(s) to be Solved by the Invention] by the way, recently color sense becomes rich and delicate also to various kinds of semi-conductor luminescence equipments -- ****** (color repeatability) -- and the stability of the luminescent color has been required. However, in conventional semi-conductor luminescence equipment which was mentioned above, the white light from which the range of fluctuation of the peak wavelength of a luminescence chip changes blue luminescence to which this peak wavelength is changed with the fluorescent substance of yellow orange luminescence for a certain reason, and is obtained about **10nm has the problem that luminescent chromaticity becomes instability.

[0006] Thus, the actual condition is that the stable luminescent chromaticity is not obtained with the semi-conductor luminescence equipment of white luminescence which combined the LED chip of the conventional blue luminescence, and the fluorescent substance of yellow orange luminescence. Then, the semi-conductor luminescence equipment obtained with easy structure in the white light by which luminescent chromaticity was stabilized is called for.

[0007] It is made in order to cope with such a technical problem, and in the case of a fluorescent substance, this invention is usually **2nm about the range of fluctuation of peak wavelength. It aims at offering the semi-conductor luminescence equipment which made it possible to obtain luminescence of the

white system by which luminescent chromaticity was stabilized with easy structure by using that it is controllable to extent.

[0008]

[Means for Solving the Problem] The luminescence chip which emits light in ultraviolet radiation as the semi-conductor luminescence equipment of this invention was indicated to claim 1, The 1st fluorescent substance layer containing the blue luminescence fluorescent substance which is formed on the luminescence side of said luminescence chip, absorbs said ultraviolet radiation, and emits light in blue glow, It is characterized by providing the 2nd fluorescent substance layer containing the yellow orange luminescence fluorescent substance which is formed on said 1st fluorescent substance layer, absorbs said blue glow, and emits light in yellow orange light.

[0009] It is a luminescence chip as the semi-conductor luminescence equipment of this invention was indicated, for example to claim 4 as a concrete configuration of the 1st and 2nd fluorescent substance layers. The configuration which made the laminated structure contain according to an individual in the resin layer which it has is mentioned in the resin layer which has a laminated structure more than two-layer in a bonnet, a blue luminescence fluorescent substance, and a yellow orange luminescence fluorescent substance. Or as indicated to claim 5, the configuration which formed the 1st and 2nd fluorescent substance layers in order as a spreading layer of a fluorescent substance on the luminescence side of a luminescence chip is mentioned.

[0010] In the semi-conductor luminescence equipment of such this invention, as indicated to claim 6, the 1st and 2nd fluorescent substance layers are constituted by the blue glow to which the 1st fluorescent substance layer absorbs ultraviolet radiation, and emits light, and the yellow orange light in which the 2nd fluorescent substance layer absorbs blue glow, and emits light so that the light of a desired white system may be obtained.

[0011] In the semi-conductor luminescence equipment of this invention, the ultraviolet radiation from this luminescence chip is changed into blue luminescence in the 1st fluorescent substance layer using the luminescence chip which emits ultraviolet radiation. The peak wavelength of the blue glow which the 1st fluorescent substance layer containing a blue luminescence fluorescent substance absorbs efficiently the ultraviolet radiation to which peak wavelength is changed in this way, and the 1st fluorescent substance layer absorbs ultraviolet radiation, and emits light although the peak wavelength of a luminescence chip has a possibility of changing by width of face of about **10nm here as mentioned above is **2nm.

The range of fluctuation is controllable to extent. And it becomes it is efficient and possible to acquire the white light by which luminescent chromaticity was stabilized dramatically by making the white light emit light with the yellow orange light in which such blue glow and the 2nd fluorescent substance layer absorb blue glow, and emit light.

[0012]

[Embodiment of the Invention] Hereafter, the gestalt for carrying out the semi-conductor luminescence equipment of this invention is explained.

[0013] Drawing 1 is the sectional view showing the outline structure of the LED lamp as 1st operation gestalt of the semi-conductor luminescence equipment of this invention. In this drawing, the main wavelength which has for example, an InGaN barrier layer 1 It is an ultraviolet LED chip near 370nm, and this ultraviolet LED chip 1 is being fixed through the adhesives layer 3 on the leadframe 2. The ultraviolet LED chip 1 and the leadframe 2 are electrically connected by the bonding wire 4.

[0014] The ultraviolet LED chip 1 mentioned above is covered with the resin layer 5 with the bonding wire 4 etc. Here, the resin layer 5 has [the perimeter of the ultraviolet LED chip 1] the wrap casting material 7 for the perimeter of the wrap pre DIP material 6 and this pre DIP material 6. The pre DIP material 6 is formed using an inorganic solvent. Both the pre DIP material 6 and the casting material 7 are formed by transparent resin etc.

[0015] Setting on the LED lamp shown in drawing 1 , the pre DIP material 6 is. It has the two-layer laminated structure and layer 6a of a wrap 1st contains the blue luminescence fluorescent substance for the perimeter of the ultraviolet LED chip 1. Furthermore, 2nd layer 6b formed on 1st layer 6a contains the yellow orange luminescence fluorescent substance. That is, layer 6a of a wrap 1st functions the luminescence side of the ultraviolet LED chip 1 as 1st fluorescent substance layer containing a blue luminescence fluorescent substance among the pre DIP material 6 which has two layer systems, and 2nd layer 6b formed on this 1st layer (1st fluorescent substance layer) 6a functions as 2nd fluorescent substance layer containing a yellow orange luminescence fluorescent substance.

[0016] Although 1st fluorescent substance layer 6a should just contain the blue luminescence fluorescent substance which absorbs ultraviolet radiation and emits light in blue glow Especially, a general formula: (M1, Eu) 10(PO4) 6 and Cl2 (among a formula) M1 it is chosen out of Mg, calcium, Sr, and Ba -- at least -- one sort of elements -- being shown -- it is expressed substantially a divalent europium activation halo phosphate fluorescent substance -- general formula: -- a(M2, Eu)

O-bAl 2O3 (the inside of a formula, and M2 -- Mg --) It is as being chosen out of calcium, Sr, Ba, Zn, Li, Rb, and Cs that it is few. One sort of elements are shown. a and b -- a> 0, b> 0, and 0.2 <=a/b<=1.5 the number to satisfy -- it is -- it is expressed substantially a divalent europium activation aluminate fluorescent substance -- General formula: a(M2, Euv, and Mnw) O-bAl 2O3 (among a formula) M2 is as being chosen out of Mg, calcium, Sr, Ba, Zn, Li, Rb, and Cs as it is few. One sort of elements are shown. a, b, v, and w -- a> 0, b> 0, 0.2 <=a/b<=1.5, and 0.001 <=w/v<=0.6 the number to satisfy -- it is -- it is expressed substantially It is desirable to make divalent europium, a manganese activation aluminate fluorescent substance, etc. contain. These blue luminescence fluorescent substances are excellent in the absorption efficiency of ultraviolet radiation, and blue glow emits light efficiently.

[0017] Moreover, although what is necessary is just to contain the yellow orange luminescence fluorescent substance which 2nd fluorescent substance layer 6b absorbs blue glow, and emits light in yellow orange light Especially, a general formula: (Y1-x-y Gdx Cey) It is expressed with 3 aluminum 5O12 (y is the inside of a formula, x and 0.1<=x<=0.55, and a number with which are satisfied of 0.01<=y<=0.4). It is desirable to make a trivalent cerium activation aluminate fluorescent substance contain. This yellow orange luminescence fluorescent substance is excellent in the absorption efficiency of blue glow, and yellow orange light emits light efficiently.

[0018] Pre DIP material 6 which is a part of resin layer 5 in the LED lamp shown in drawing 1 as mentioned above 1st fluorescent substance layer 6a and 2nd fluorescent substance layer 6b are formed by considering as two-layer structure and making a blue luminescence fluorescent substance and a yellow orange luminescence fluorescent substance contain according to an individual in each class of these pre DIP material 6. 1st fluorescent substance layer 6a containing a blue luminescence fluorescent substance is formed on the luminescence side of the ultraviolet LED chip 1, as mentioned above, and 2nd fluorescent substance layer 6b containing a yellow orange luminescence fluorescent substance is formed on 1st fluorescent substance layer 6a.

[0019] Each class of the pre DIP material 6 which functions as 1st fluorescent substance layer 6a and 2nd fluorescent substance layer 6b For example, after fixing the ultraviolet LED chip 1 on a leadframe 2, the thermosetting resin containing a blue luminescence fluorescent substance for pre DIP material and the thermosetting resin containing a yellow orange luminescence fluorescent substance for pre DIP material are applied in order. It is formed by stiffening the

thermosetting resin which heat-treats and contains a fluorescent substance. After covering the perimeter of such pre DIP material 6 by the casting material 7, the LED lamp shown in drawing 1 is obtained by performing heat treatment and stiffening the casting material 7.

[0020] The formation process of the pre DIP material 6 can also be beforehand formed at the wafer process as a production process of the ultraviolet LED chip 1. In this case, after making much ultraviolet LED chips to a semi-conductor wafer, the pre DIP material layer which functions as 1st fluorescent substance layer 6a is formed, and the pre DIP material layer which functions as 2nd fluorescent substance layer 6b subsequently to a it top is formed so that the luminescence side of these ultraviolet LED chip may be covered first. Then, a semi-conductor wafer is divided into each ultraviolet LED chip, and the ultraviolet LED chip 1 which has these 1st and 2nd fluorescent substance layers 6a and 6b is fixed on a leadframe 2. And after the pre DIP material 6 covers the perimeter of the ultraviolet LED chip 1 formed beforehand by the casting material 7, the LED lamp shown in drawing 1 is obtained by performing heat treatment and stiffening the casting material 7.

[0021] In the LED lamp mentioned above, the ultraviolet radiation which emitted light from the ultraviolet LED chip 1 is absorbed by 1st fluorescent substance layer 6a containing a blue luminescence fluorescent substance, and blue glow emits light from 1st fluorescent substance layer 6a. Here, although the peak wavelength of the ultraviolet radiation which emits light from the ultraviolet LED chip 1 has a possibility of changing by width of face of about **10nm, 1st fluorescent substance layer 6a absorbs efficiently the ultraviolet radiation to which peak wavelength is changed in this way, it is efficient and blue glow emits light.

[0022] Furthermore, the peak wavelength of the blue glow to which 1st fluorescent substance layer 6a absorbs ultraviolet radiation, and emits light is **2nm. The range of fluctuation is controllable to extent. Therefore, while being able to stabilize substantially the luminescent chromaticity of the white light acquired by the blue glow which emits light from 1st fluorescent substance layer 6a, and the yellow orange light which 2nd fluorescent substance layer 6b absorbs this blue glow, and emits light, it becomes it is efficient and possible to acquire the white light.

[0023] The luminescent color of the LED lamp of this operation gestalt can be made into the light of a desired white system by adjusting each amount of fluorescent substances in 1st and 2nd fluorescent substance layer 6a and 6b, the thickness of the 1st and 2nd fluorescent substance layers 6a and 6b, etc. Under the present circumstances, it is possible not only the pure white light but to acquire the white light which blue cut depending on the application of an LED lamp, the white light

which yellow orange cut. Thus, various conditions are set up by the yellow orange light in which the blue glow to which 1st fluorescent substance layer 6a absorbs ultraviolet radiation, and emits light, and 2nd fluorescent substance layer 6b absorb blue glow, and the 1st and 2nd fluorescent substance layers 6a and 6b emit light so that the light of a desired white system may be obtained.

[0024] Drawing 2 is the sectional view showing the outline structure of the LED lamp as 2nd operation gestalt of the semi-conductor luminescence equipment of this invention. In the LED lamp shown in drawing 2 , the ultraviolet LED chip 11 has the wavelength conversion layer 12 which changes the wavelength of the ultraviolet radiation emitted from it. The blue luminescence fluorescent substance layer (1st fluorescent substance layer) 13 which absorbs an ultraviolet radiation component and emits light in blue glow to the ultraviolet LED chip 11 side is formed, and the yellow orange luminescence fluorescent substance layer (2nd fluorescent substance layer) 14 which absorbs a blue glow component and emits light in yellow orange light is formed in that top face so that this wavelength conversion layer 12 may be expanded to drawing 3 and may be shown.

[0025] After making much ultraviolet LED chips for example, to a semi-conductor wafer, the yellow orange luminescence fluorescent substance layer 14 as the blue luminescence fluorescent substance layer 13 as a fluorescent substance layer of these 1st and 2nd fluorescent substance layer forms the blue glow luminescence fluorescent substance layer 13 and the yellow orange luminescence fluorescent substance layer 14 in order as a spreading layer of a fluorescent substance so that the luminescence side of these ultraviolet LED chip may be covered first. These fluorescent substance layers 13 and 14 can be formed using the various forming-membranes methods, for example, the forming-membranes method like a spin coat method is used.

[0026] Then, the LED lamp shown in drawing 2 is obtained by dividing a semi-conductor wafer into each ultraviolet LED chip, performing heat treatment and stiffening the casting material 7 (heat-curing resin layer 5), after this blue glow luminescence fluorescent substance layer 13 and the yellow orange luminescence fluorescent substance layer 14 fix the ultraviolet LED chip 11 formed beforehand on a leadframe 2 and cover the perimeter of the ultraviolet LED chip 11 by the casting material 7.

[0027] Also in the LED lamp of the 2nd operation gestalt, like the 1st operation gestalt, the ultraviolet radiation which emitted light from the ultraviolet LED chip 11 is absorbed by the blue luminescence fluorescent substance layer 13, and blue glow emits light from the 1st fluorescent substance layer 13. Although the peak

wavelength of the ultraviolet radiation which emits light from the ultraviolet LED chip 11 has a possibility of changing by width of face of about **10nm, the blue luminescence fluorescent substance layer 13 absorbs efficiently the ultraviolet radiation to which peak wavelength is changed in this way, it is efficient and blue glow emits light.

[0028] Furthermore, the peak wavelength of the blue glow to which the blue luminescence fluorescent substance layer 13 absorbs ultraviolet radiation, and emits light is **2nm. The range of fluctuation is controllable to extent. Therefore, while being able to stabilize substantially the luminescent chromaticity of the white light acquired by the blue glow which emits light from the blue luminescence fluorescent substance layer 13, and the yellow orange light which the yellow orange luminescence fluorescent substance layer 14 absorbs this blue glow, and emits light, it becomes it is efficient and possible to acquire the white light. The luminescent color of the LED lamp of this 2nd operation gestalt can be made into the light of a desired white system like the 1st operation gestalt.

[0029]

[Example] Next, the concrete example and its assessment result of semi-conductor luminescence equipment of this invention are described.

[0030] The LED lamp shown in example 1 drawing 1 was produced using the blue luminescence fluorescent substance and yellow orange luminescence fluorescent substance which are shown in a table 1. Ten LED lamps were produced and measured the luminescent chromaticity of these ten LED lamps. The average of luminescent chromaticity and the range of fluctuation of luminescent chromaticity are shown in a table 1 as the result.

[0031] Moreover, main wavelength is abbreviation as an example 1 of a comparison with this invention. While using the GaN system LED chip which emits light in the blue glow near 450nm, the LED lamp in which only the fluorescent substance layer containing a yellow orange luminescence fluorescent substance was formed was produced. Ten LED lamps were produced and measured the luminescent chromaticity of these ten LED lamps. The average of luminescent chromaticity and the range of fluctuation of luminescent chromaticity are collectively shown in a table 1 as the result.

[0032]

[A table 1]

	LEDチップ	青色蛍光体	黄橙色蛍光体	発光色度(n=10)			
				平均値		変動幅	
				x	y	x	y
実施例1	紫外発光	(Sr0.73Ba0.22Ca0.05)10(PO4)6・Cl2:Eu	(Y0.45Gd0.40)3Al5012:Ce0.15	0.300	0.278	±0.004	±0.004
比較例1	青色発光	−	同上	0.301	0.280	±0.015	±0.015

It turns out that the white light in which the chromaticity of the LED lamp of white luminescence by the example 1 was stable compared with the LED lamp (example 1 of a comparison) of the conventional white luminescence is acquired so that clearly from a table 1.

[0033] The LED lamp shown in an example 2 and 3 drawing 1 was produced using the blue luminescence fluorescent substance and yellow orange luminescence fluorescent substance which are shown in a table 2 (example 2) and a table 3 (example 3). Ten LED lamps were produced, respectively and measured the luminescent chromaticity of these ten LED lamps. The average of luminescent chromaticity and the range of fluctuation of luminescent chromaticity are shown in a table 2 and a table 3 as the result.

[0034] Moreover, main wavelength is abbreviation as examples 2 and 3 of a comparison with this invention. While using the GaN system LED chip which emits light in the blue glow near 450nm, the LED lamp in which only the fluorescent substance layer containing a yellow orange luminescence fluorescent substance was formed was produced, respectively. Ten LED lamps were produced, respectively and measured the luminescent chromaticity of these ten LED lamps. The [table 2] showing the average of luminescent chromaticity, and the range of fluctuation of luminescent chromaticity in a table 2 and a table 3 collectively as the result

	LEDチップ	青色蛍光体	黄橙色蛍光体	発光色度(n=10)			
				平均値		変動幅	
				x	y	x	y
実施例2	紫外発光	(Ba0.80Eu0.20Mg1.00)0・5Al203	(Y0.60Gd0.20)3Al5012:Ce0.20	0.370	0.452	±0.004	±0.004
比較例2	青色発光	−	同上	0.368	0.455	±0.015	±0.015

[A table 3]

	LEDチップ	青色蛍光体	黄橙色蛍光体	発光色度(n=10)			
				平均値		変動幅	
				x	y	x	y
実施例3	紫外発光	(Ba0.85Eu0.15Mg0.99 Mn0.01)O・5Al2O3	(Y0.50Gd0.35)3 Al5O12:Ce0.15	0.272	0.325	±0.004	±0.004
比較例3	青色発光	−	同上	0.270	0.323	±0.015	±0.015

It turns out that the white light by which the chromaticity was stabilized compared with the LED lamp (examples 2 and 3 of a comparison) of white luminescence of the former [lamp / of white luminescence by examples 2 and 3 / LED] respectively is acquired so that clearly from a table 2 and a table 3.

[0035]

[Effect of the Invention] As explained above, according to the semi-conductor luminescence equipment of this invention, it becomes possible to obtain the light of the white system of the request by which luminescent chromaticity was stabilized efficient with easy structure. According to the semi-conductor luminescence equipment of such this invention, the applicable field of the semi-conductor luminescence equipment of white luminescence can be extended substantially, and it contributes to improvement in the practicability of semi-conductor luminescence equipment greatly.

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view showing the outline structure of the LED lamp as 1st operation gestalt of the semi-conductor luminescence equipment of this invention.

[Drawing 2] It is the sectional view showing the outline structure of the LED lamp as 2nd operation gestalt of the semi-conductor luminescence equipment of this invention.

[Drawing 3] It is drawing showing typically the important section structure of the ultraviolet LED chip used with the LED lamp shown in drawing 2 .

[Description of Notations]

1 .... Ultraviolet LED chip

2 .... Leadframe

4 .... Bonding wire

5 .... Resin layer

6 .... Pre DIP material

6a, 13 .... 1st fluorescent substance layer

6b, 14 .... 2nd fluorescent substance layer

7 .... Casting material

12 .... Wavelength conversion layer